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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/063,880

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Kuo-Ming Chen

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NAIPO (NORTH AMERICA INTERNATIONAL PATENT OFFICE)

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EXAMINER

NGUYEN, DILINH P

ART UNIT

PAPER NUMBER

2814

DATE MAILED: 11/16/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/063,880

Applicant(s)

CHEN, KUO-MING

Examiner

DiLinh Nguyen

Art Unit

2814

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 30 September 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-5, 7, 9-26, 28-33 and 35-37 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-5, 7, 9-26, 28-33 and 35-37 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Objections

1. Claim 17 recites the limitation "a second corner region" in line 17. There is insufficient antecedent basis for this limitation in the claim.

Claim 37, line 2, replace "a plurality of first solder pads" with --the plurality of first solder pads--.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 36-37 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

- Regarding claim 36, the limitations "a plurality of second solder pads arranged in a ring" and "the second solder pads being positioned only at corners of the substrate" render the claim indefinite.

It is not clear how the second solder pads arranged in the ring and at the same time positioned only at corners of the substrate.

The specifications and the drawings disclose that the second solder pads arranged in a ring (fig. 10) and, in another embodiment, the second solder pads positioned only at corners of the substrate (fig. 11).

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

5. Claims 1, 5, 7 and 35 are rejected under 35 U.S.C. 102(e) as being anticipated by Potter et al. (U.S. Pat. 6,444,563) [newly cited].

Potter et al. (figs. 3-7, column 3, lines 5 et seq.) disclose solder pads for improving reliability of a package, the package comprising a substrate 20 or 26 (fig. 3, column 3, lines 11-15) the solder pads with two sizes of diameters comprising:

a plurality of first solder pads 12 positioned on a surface of the substrate to occupy the entire surface of the substrate except the corners, each of the first solder pads having a first diameter; and

at least a second solder pad 22 positioned on a corner region of the substrate surface, the second solder pad having a second diameter greater than the first diameter to sustain a stronger thermal stress and a stronger fatigue strength (column 5, lines 5-8).

- Regarding claim 5, Potter et al. disclose that the substrate 20 comprises a chip (figs. 3-7, column 3, line 4).
- Regarding claim 7, Potter et al. disclose that portions of the first solder pads are arranged in a rectangular array at a center regions of the substrate (fig. 3).

- Regarding claim 35, Potter et al. disclose that the first solder pads are arranged out of the rectangular array and adjacent to the second solder pad on the corner region (fig. 3).

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 2-4 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Potter et al. (U.S. Pat. 6,444,563) [newly cited] in view of Guzik et al. (U.S. Pat. 5153379) [previously applied].

Potter et al. disclose the claimed invention except for not specifically point out that the substrate comprises a plastic substrate or a ceramic substrate.

However, Guzik et al. disclose a semiconductor device comprising a substrate and wherein the substrate is preferably a ceramic board, an insulating material such as glass epoxy board or a printed circuit board (column 2, lines 39-45). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to replace the substrate of Potter et al. by a ceramic board, a glass epoxy board or a PCB, as taught by Guzik et al., in order to increase the heat dissipating characteristics.

- Regarding claim 13, Guzik et al. disclose the corner region comprises at least a grounded solder pad (column 1, lines 66-67 and column 2, lines 5-6).

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8. Claims 9-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Potter et al. (U.S. Pat. 6,444,563) [newly cited] in view of Applicant Admitted Prior Art (figs. 1 and 4).

- Regarding claim 9, Potter et al. disclose the claimed invention except for not specifically point out that the corner region comprises the circumferences of a plurality of concentric circles on the substrate.

However, AAPA (fig. 4) disclose a plurality of first solder pads 14 and a plurality of second solder pads 24, the plurality of second solder pads 24 positioned on a corner region; wherein the corner region comprises the circumferences of a plurality of concentric circles on the substrate. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the substrate of Potter et al. by having the circumferences of a plurality of concentric circles at the corner region, as taught by AAPA (figs. 1 and 4), to prevent the package not crack easily at the corner of the chip.

- Regarding claim 10, AAPA discloses the second solder pads on each of the concentric circle circumferences are arranged with an equal interval (fig. 4).
- Regarding claim 11, AAPA discloses the corner region comprises the corners of the substrate on an outside portion of a maximum circle on the substrate (fig. 4).
- Regarding claim 12, AAPA discloses the corner region comprises the circumference of a maximum circle on the substrate (fig. 4).

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9. Claims 14-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Potter et al. (U.S. Pat. 6,444,563) [newly cited] in view of Taniguchi et al. (U.S. Pat. 6,404,062) [newly cited].

- Regarding claims 14-15, Potter et al. fail to disclose a solder bump, a chip and an underfill layer.

However, Taniguchi et al. (figs. 4-5, column 2, lines 21 et seq.) disclose a semiconductor device comprising:

a substrate 23; the first solder pads and the second solder pad comprise a solder bump pad 16, the solder bump pad connecting to a solder bump 14 and using the solder bump to connect to a chip 11; an underfill layer 18 in a gap between the chip 11 and the substrate 23. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Potter et al. by having the solder bump, the solder pad and the underfill layer, as taught by Taniguchi et al., in order to form a multiple housing package and to reduce mismatch of a coefficient of thermal expansion of the die with the substrate.

- Regarding claim 16, Taniguchi et al. disclose that the first and second solder pads comprise a solder ball pad 21, the solder ball pad connecting to a solder ball 13 and using the solder ball to connect to a printed circuit board 19 (fig. 5).

10. Claims 17, 20-22 and 28-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pu et al. (U.S. Pat. 6350669) [previously applied] in view of Ishii (JP. 2001-257289) [previously applied].

Pu et al. discloses a semiconductor device (cover fig.) comprising:

a substrate 310;

a plurality of first solder bump pads A2 positioned on a first surface of the substrate, each of the first solder bump pads having a first diameter and

at least a second solder bump pad A1 positioned on a first predetermined region of the first surface, the second solder bump pad having a second diameter greater than the first diameter (column 4, lines 52-54), each of the first solder bump pads and the second solder bump pad being connected to a solder bump 321 that is connected to a chip 300.

Pu et al. fail to disclose a plurality of first solder ball pads positioned on a second surface of the substrate, each of the first solder ball pads having a third diameter, and at least a second solder ball pad positioned on a second predetermined region of the second surface, the second solder ball pad having a second diameter greater than the third diameter.

However, Ishii discloses a semiconductor device (figs. 7a-b) comprising:

a plurality of first solder ball pads 2d positioned on a second surface of the substrate 1; each of the first solder ball pads having a third diameter; and

at least a second solder ball pad 2a positioned on a second predetermined region of the second surface, the second solder ball pad having a fourth diameter greater than the third diameter, each of the first solder ball pads and the second solder ball pad being connected to a solder ball 3 that is connected a circuit board 7 (figs. 9a-b). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Pu et al. by having the diameter of

the second solder ball pad greater than the diameter of the first solder ball pad, as taught by Ishii, to provide a high reliability for the semiconductor package device and relax the influence of distortion caused by difference in thermal expansion between the package and the mounting board.

- Regarding claim 20, since Pu et al. and Ishii disclose all claimed structural features. Therefore, the package inherently comprises a high stress region at the first predetermined region and the second predetermined region.
- Regarding claims 21 and 28, Ishii discloses that the small diameter pads are arranged in a matrix at a center region of the substrate (figs. 7a-7b).
- Regarding claims 22 and 29, Ishii discloses that the predetermined region comprises the corners on the surface of the substrate (figs. 7a-7b).

11. Claims 18-19,23-26 and 30-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pu et al. (U.S. Pat. 6350669) [previously applied] in view of Ishii (JP. 2001-257289) [previously applied] and further in view of AAPA (figs. 1 and 4).

- Regarding claims 23 and 30, as discussed in details above, the combination of Pu et al. and Ishii disclose all the limitations as claimed above except for not specifically point out that the predetermined region comprises the circumferences of a plurality of concentric circles on the substrate.

AAPA (figs. 1 and 4) disclose a plurality of first pads 14 and a plurality of second pads 24, the plurality of second pads 24 positioned on a predetermined region; wherein the predetermined region comprises the circumferences of a plurality of concentric circles on the substrate. Therefore, it would have been obvious to one having ordinary

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skill in the art at the time the invention was made to modify the above combination by having the circumferences of a plurality of concentric circles at the corner region, as taught by AAPA (figs. 1 and 4), to prevent the package not crack easily at the corner of the chip.

- Regarding claims 18-19, AAPA discloses that a substrate 18 comprises a plastic substrate or a ceramic substrate (fig. 1).
- Regarding claims 24 and 31, AAPA discloses that the second pads on each of the concentric circle circumferences are arranged with an equal interval (fig. 4).
- Regarding claims 25 and 32, AAPA discloses that the predetermined region comprises the corners of the substrate on an outside portion of a maximum circle on the substrate (fig. 4).
- Regarding claims 26 and 33, AAPA discloses that the predetermined region comprises the circumference of a maximum circle on the substrate (fig. 4).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DiLinh Nguyen whose telephone number is (571) 272-1712. The examiner can normally be reached on 8:00AM - 6:00PM (M-F).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571) 272-1705. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

DLN

A handwritten signature in black ink, appearing to read 'Hoai Pham', with a stylized, cursive script.

HOAI PHAM
PRIMARY EXAMINER